Collaboration report PANDA progress in 2013

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The PANDA Experiment (antiProton-Annihilation at Darmstadt) is a dedicated hadron physics experiment with a focus on the structure and dynamics of hadrons with explicit scientific programs in

- charm spectroscopy and the search for exotic hadronic matter,
- hadron dynamics of baryons and mesons,
- hadron structure and proton formfactors,
- hypernuclei (single and double strange), and
- hadrons (in particular J/psi) in nuclear media.

These goals will be achieved by utilizing a 1.5-15 GeV/c antiproton beam which annihilates off a proton or a nuclear target. The PANDA experiment comprises an onion-like detector structure enabling tracking, calorimetry and particle identification for a variety of particle species over a wide momentum and rapidity range.

The phase of development and construction of PANDA is progressing very well at GSI and it's partners and is in line with the FAIR construction schedules. A great success is that three more TDRs of PANDA were approved by FAIR: Straw Tube Tracker (STT) in January 2013, Micro Vertex Detector (MVD) in February 2013 and the Cluster Target in August 2013. Apart from development and construction of several detectors and parts, the GSI group is also responsible for the technical coordination and the infrastructure for the PANDA experiment.

For the construction of the PANDA solenoid is well under way and a cooperation with the ATLAS magnet group was initiated. The mechanical design of the yoke and support platform were studied with FEM calculations and a construction contract is envisaged for 2014. The architectural design of the PANDA Experimental Hall reached the next level of detail and was checked and improved and at the same time the routing of services and installation planning were expedited. Another important step is that new crystals have been produced by SICCAS in Shanghai (China) for the PANDA calorimeter and were characterized at Gießen.

GSI is involved in the research, development and the construction of the DIRC (Detector for Internally reflected Cherenkov Light), the EMC (Electromagnetic Calorimeter) and the GEM-Discs (Gas Electron Multiplier).

The DIRC is an assembly of either narrow slabs or bars of artificially fused silica, where Cherenkov light of traversing particles is internally reflected to one end, where the individual photons are registered and time tagged with photon detectors. In simulations the layout of radiators and focusing elements of the barrel DIRC was optimized with respect to resolution, granularity and expected production cost. The GSI partners in Erlangen characterized micro-channel plate photomultipliers that have an enhanced lifetime achieving now for the first time the limits necessary for a long-term operation in the PANDA experiment. Both are important steps towards the completion and the start of construction of this particular device.

The EMC consists of several lead-tungstate crystal arrangements in a backward, a barrel and a forward section. The light collected by the crystals from electromagnetic showers is detected with LAAPDs (Large Area Avalanche Photodiodes) with a large collection area (1 square cm) and a high gain. The final version of the LAAPD for the PANDA EMC was established and a pre-production batch was ordered by RU Bochum to be characterized at GSI. For maximum throughput and quality assurance the construction of the APD screening lab was started at a new dedicated location and will be finished in 2014.

The GEM Tracker consists of a series of circular planes to cover mainly particles from the forward-peaked event topologies. In 2013 the layout of the readout pad plane was simulated to find an optimal value for occupancy, resolution and number of channels. In addition the quality assurance for large-scale GEM foils was successfully developed. Finally for the reconstruction of realistic tracks in the GEM Tracker a time-based approach was implemented.

In addition the GSI groups are involved in electronics, software and data acquisition. Details can be found throughout the report.Since several decades, the year 2013 was the first year without beamtimes at GSI. Various NUSTAR detectors and sub-systems for FAIR are already in operation and the collaboration looks forward to their implementation and use at FAIR. The lack of beamtime induced a serious change of the daily scientific work and hampered the beam-related preparations of FAIR experiments, component tests and R&D-work, including pilot experiments for FAIR.

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